Project Haystack

ISSUE 12

connections

Journal of the Haystack Community - Solutions for Interoperable Device Data

Net Zero, Decarbonization and ESG Made Possible by Smarter Buildings



XETO Update • Haystack eLearning Courses
New Open-Source Community Project Called Phable
Project Haystack. Contributing to Data Models & Standards

Generative AI NeedsTagging

Reducing Carbon Emissions With the Use of Haystack Tagging

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Tridium invites you to its gathering of the Niagara Community. We are planning an agenda around the technology and business topics that are driving our connected world and accelerating innovation.

Contact us at niagarasummit@tridium.com for more information.

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Net Zero, Decarbonization and ESG Made Possible by Smarter Buildings Using Project Haystack

by Robin Bestel, Managing Editor, Project Haystack Connections Magazine

Pelcome to the 12th issue of the Project Haystack Connections Magazine. This issue once again demonstrates the importance of the work being done by the worldwide Project Haystack Community.

For anyone in this industry, the accomplishments made the past few years and going forward, are important to everyone as the need for building smart buildings gets stronger and stronger. As major goals set by world leaders, Net Zero, Decarbonization and ESG, they might only be acheived by our industry by widening Project Haystack's interoperability inorder to create a world of Smarter Buildings.

This issue of Connections Magazine consists of the latest updates on the Project Haystack organization, the Haystack standards and work in progress by the Project Haystack Working Groups. There are several contributed articles by companies that are building Haystackcompatible products and developing new methodologies.

In Nashville in June, the Project Haystack organization once again held its in-person, biennial Haystack Connect Conference 2023. It proved to be another success with great attendance by the Haystack Community and over 40 presentations were given over the course of the 3-day conference. Many of the presentations are available on the Haystack Connect 2023 website. I hope you will join me in welcoming our newest Associate Members, Alperia Group, Midea Building Technologies, Nanjing Chinwell Technology and One SightSolutions, to the Project Haystack organization and are featured in the section "New Member Profiles".

Any and all suggestions about our Connections Magazine and marketing.project-haystack.org website can be sent to robin@haystackconnect.org.

Thank you everyone for all the support and contributions to produce this 12th Issue of the Project Haystack Connections Magazine!



Board Members















Associate Members





Message from the Board Data and its Journey Continues

Thank you to everyone one engaged in the Project Haystack community working to advance the use of building data and metadata to create more value from buildings and drive down carbon emissions through these efforts! We are excited to work with you to move Project Haystack forward and to foster greater adoption and innovation in the years ahead.

This year we had an amazing Haystack Connect event in Nashville that was well attended by movers and shakers across our industry. We heard about lots of great work across the Haystack community, such as storing Haystack tagged models in cloud repositories, enhanced tools for Haystack tagging, new products leveraging Haystack and so much more.

We were especially excited to see the new ideas around validating and standardizing Haystack models for greater interoperability and fulfilling specific use cases. For example, two great initiatives shared their progress in this direction named Project Xeto and Hayloft. Funded research to advance the Project Xeto validation tools are continuing and have great potential to make real interoperability easier and more scalable. The feedback we have received around the BENEFIT Project and the Xeto technology have been positive and it is pleasing to see the enthusiasm our community has for this groundbreaking work. It is still to be decided how initiatives like these will be incorporated into Haystack and how validation tools for models can be made available throughout the community.

Since Haystack Connect 2023 in June, the Project Haystack Board of Directors has been reflecting on the future, including the vision and strategic mission for our community and technology, as well as looking at implementing some of the real practical changes required to take us as an organization forward into our next decade. Part of that vision is working with member organizations to refine the mission statement and develop structures to work collaboratively across the industry and to have Project Haystack continue to be adopted as the leading standard for data and data modeling. The Project Haystack Organization has traditionally focused on providing the general concepts for standardizing and optimizing the use of data, but we also see the need for more rigorous validation in the future. We want to open a dialogue with the community on how best to do this. So stay tuned!

Looking forward, we are excited about the idea of working more with the Haystack member companies to inform the evolution of the Haystack ontologies, to promote the adoption of the technology, and to foster interoperability among applications and devices supporting Haystack for the benefit of customers. We're also enthusiastic about providing technical contributors an easy and well-defined pathway to incorporate new ideas into the Haystack ontology through the Project Haystack Working Groups.

And, speaking of member companies, we are glad to see the growth of Project Haystack continue across the globe. Alperia Group, Midea, Nanjing Chinwell Technology and OneSight Solutions have all become Associate Members in 2023. The need for Haystack, building ontologies, and metadata standards has never been greater. This community is diverse, global, and applying metadata for real-world applications in real buildings. It is a community that spans integrators, mechanical engineers, commissioning agents, researchers, and many other disciplines with a shared vision that metadata standards and interoperability will transform the industry for the better for many years to come. Thank you for your contributions to the community and to moving the vision forward! We are excited to continue on this journey with such an awesome Project Haystack community! Keep making it happen!

Thank You. 💥

The Project Haystack Executive Board Members

Nick Gayeski, PhD, Co-Executive Director Richard McElhinney, Co-Executive Director Alex Rohweder, Co-Executive Director Marc Petock, Executive Secretary



Nick Gayeski, PhD, is the CEO and Co-Founder of Clockworks Analytics and a Co-Executive Director of Project Haystack. He is passionate about transforming the facilities industry by empowering facilities teams with technology to achieve massive positive impact in the built environment.



Alex Rohweder is a Co-Executive Director of Project Haystack. Alex joined J2 Innovations in 2018 from Siemens and as CEO brings his passion and expertise in building automation software, corporate strategy, portfolio management and OEM sales to the company.



Richard McElhinney is a Co-Executive Director of Project Haystack and is the Vice President of Technology at Conserve It. Richard has over 25 years experience in product and solution development having worked globally with leading companies in the Smart Building Services space.



Marc Petock is Executive Secretary on the Board of Project Haystack and Chief Marketing & Communications Officer at Lynxspring, Inc. Lynxspring is a Founding Member of Project Haystack and leading developer and manufacturer of smart building technologies and solutions.



XETO Update

Haystack4

The Building Technologies Office Energy Efficiency Frontiers & Innovation Technologies (BENEFIT), a project funded by the US Department of Energy to bring new validation techniques and tools to the Haystack community, has continued its development to design a solution for templating and validation.

At Haystack Connect 2023, we unveiled a new name for this technology: XETO (coined from the phrase eXtensible Extendable Typed Objects). XETO is just a new name for previously showcased designs that went by Protos or Pog files.

This summer, an open-source implementation of the XETO toolset was released which provides command line tools for compiling XETO libs and validating Haystack data. These tools are bundled into the 3.1.8 version of Haxall which may be downloaded from https://haxall.io.

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This YouTube video shows how to use the Xeto tools: https://www.youtube.com/watch?v=UvxWmU72wvs.

Since Haystack Connect 2023, we have created a new Working Group to focus on the XETO design and its integration into the Haystack technology stack.

Join our XETO Working Group **WG #1072**. We are meeting every other week on Tuesday at 11am ET.

The proposed scope of work for this new WG is:

- Shepherd XETO into a real specification
- Decide how XETO integrates into Project Haystack's technology stack
- Development practices (GitHub, PR management, etc)
- What libraries should Project Haystack standardize (points, attributes, etc)
- Feature set required for cloud repository
- Explore integration of XETO queries into HTTP API
- Explore possibility of replacing source defs now in Trio files with XETO

We encourage anyone interested to join our Working Group sessions!



Brian Frank serves as the technical lead for Project Haystack, working with the Project Haystack community to curate domain models and technical specifications. He is also President and Co-Founder of SkyFoundry, a software company specializing in storage, analysis, and visualization of data from the IoT.



New Open-Source, Community Project Called Phable



The word Phable in this context is meant to be another way of expressing the idea of "Project Haystack ABLE." Phable is a Python library that allows for connecting to a Haystack server and evaluating the about, close, read, hisRead, and hisWrite ops defined by Project Haystack and another evaluation operation called eval using the JSON data format.

Careful attention has been put into Phable's design to make it easy to use and to structure data received by the server in a ready to use format for data analysis. An option to use a context manager is included to automatically close the session with the Haystack server.

This project intends to make it easy to fetch and structure data from a Haystack server within a Jupyter Notebook using Python and has other possible use cases.

Motivation for Phable

Python is the world's most popular programming language for applying data science and machine learning in real world applications. In the past several years considerable improvements have been made to improve Python, including the addition of asyncio and type hints, improved datetime and timezone support, increased speed, and more. Phable takes advantage of these improvements.

Phable Design Philosophies

There are several noteworthy design philosophies behind Phable:

- 1. Use Python 3.11 or higher to take advantage of the recent improvements to Python
- Avoid Python library dependencies currently Phable only depends on the Pandas library which we are hoping to remove in the future
- 3. Python classes are used to define Haystack kinds which do not map directly to native Python types
- DateRange and DateTimeRange dataclasses in the kinds module are used to support the HisRead operation
- 5. The __str__ method on classes in the kinds module are used to define how the objects are displayed to a user (e.g., within a Pandas DataFrame that is displayed)
- 6. Use the Client class and its methods to manage the client interface to the Haystack server

Future Development Plans

We are considering improving Phable by:

- 1. Adding TLS support
- 2. Utilizing the Python Dataframe interchange protocol to remove the dependency on the Pandas library and to support other dataframe libraries such as Polars
- 3. Introducing optional data type validation
- 4. Improving error messages
- 5. Adding support for more Haystack operations

Also, we will continue to improve documentation and consider any feedback from the Haystack community on how we may improve this library.

Wrap Up

We would like to invite you to check out and contribute to the Phable project on the GitHub link below. We would love your feedback!

https://github.com/rick-jennings/phable. 💥



Rick Jennings, PE, CEM, is a Data Analytics Application Engineer at SkyFoundry and has over 10 years of electric power engineering experience involving nuclear propulsion systems, traction converters used in rail vehicles, data centers, and electric vehicle charging infrastructure.



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Haystack 4 eLearning Course



"Project Haystack is proud to bring you our official eLearning course - Haystack Essentials. In collaboration with accredited eLearning training provider, Fantom Factory, we have online interactive training on demand!"

Project Haystack is proud to bring you our official eLearning Training Course, Haystack Essentials.

If you're new to the world of Project Haystack, this course will help you to understand both why and how to apply Project Haystack tags into built environment.

Starting at the very beginning, you'll learn all about the kinds of data tags you can use and where to reference them in the open source libraries. Using interactive exercises in the digital screens, you'll practice applying these tags into sample scenarios which increase in complexity.

Who Is It For?

The Haystack Essentials eLearning Course is designed for professionals across all experience levels to learn about Project Haystack from the very beginning.

If you're joining a new team, learning a new technology, consolidating your existing skills and knowledge, or perhaps you'd just like to know what Project Haystack is all about, this course will ensure you will cover ALL of the "essentials".

What Will I Learn?

You will gain a practical understanding of how to apply Project Haystack tags to a data model.

Your learning journey will start from the very beginning with the syntax and makeup of the tags themselves. As you explore the ontology of these tags, you will learn how Project Haystack applies inherent meaning through these tag relationships to harness the real power behind this modeling standard. In the latter part of the course, you will work through exercises requiring you to reference the Project Haystack developers website, www.projecthaystack.org, as we guide you through applying tags to a range of equipment models.

By the end of the Haystack Essentials eLearning Course, you will gain the understanding and the confidence to apply richer meaning to your data models using Haystack tags and resources.

Haystack Essentials Syllabus

- Module 1 Introduction Haystack
- Module 2 Tag Kinds and Values
- Module 3 Navigating Haystack Libraries and Resources
- Module 4 My First Data Model
- Module 5 More Tagging Models
- Module 6 Course Revision and Assessment

Read the Full Curriculum here.

Learn more about Haystack Essentials in this promotional video: https://youtu.be/ FcTT629Eg7o

Download the Brochure.

How Can I Take The Course?

Online, at your own pace, in your own time, and from anywhere you choose!

Upon purchasing a seat to the course, you'll immediately receive an access code and some easy instructions on how to get started on the Fantom Factory eLearning Platform. It takes less than a minute to create an eLearning account and redeem your access code for this course.

Log in and out to resume the course at any time to suit your own schedule and to work through the 36 content pages, 6 detailed tutorial videos and around 90 interactive questions.

As accredited providers of training excellence, Fantom Factory offers digital certification which will award 12 accredited units/hours for this course towards Continued Education (or Continued Professional Development).





The Haystack Essentials Journal

After you complete the training, we automatically provide long-term access to the training notes and references in a handy JOURNAL accessible in your eLearning account.

How Much Is It?

The Haystack Essentials eLearning Course is priced at just \$125 and is accessible on Fantom Factory.

Still not sure if this is for you? Well, we have good news! The first training module is available for FREE.

"**Module 1 - Introducing Haystack**" is available as a free trial course. Just use the access code HAYSTACK-INTRO or for more details, visit the **Fantom Factory** website. X



Emma Eynon co-founded Fantom Factory to help make technology accessible to those who aspire to save our planet. She is passionate about training and communication, and has a wealth of experience in technical writing and content management systems.



Project Haystack. Contributing to Data Models & Standards



Data. It is transforming everything. It has changed how companies in every industry do business and manage performance. And it is no secret that data is the most valuable information in the smart building environment. The challenge is to make the data available in the right format and deliver it to the right person at the right place and time within a secure environment. This is the basic requirement to create a data value chain.

However, data can be bewildering and meaningless. We need to move past "data drowning" and get to a point where we are employing data modeling and standardization. Access to good data is one of the fundamental requirements for owners, operators, and service providers to maximize the performance and efficiency of their facilities.

However, significant differences in how data is identified and made ready for the different stakeholders continues to present a challenge. Achieving a common dataset and standard enables more accurate business decisions, reduces errors, and helps ensure the overall integrity and governance of the data. No other element that has had a bigger impact on this than data modeling. Data modeling is part of a structured ontology approach to maximizing use of data.

So, what is a data model? In simplest terms, data models visually represent the data gathered from the connected systems, equipment, and devices that are organized around the requirements of the stakeholders who will utilize this data. It serves as a blueprint or representation of how data is organized, stored, and accessed within a database. The importance of a data model cannot be overstated, as it lays the foundation for efficient data management, accurate information retrieval, and effective communication between different stakeholders. At its core, a data model forms the basis for standardizing data across a wide range of input data from various devices, equipment, and systems. In our case, Project Haystack is a fundamental contributor to a data model by enabling users to standardize, contextualize, tag, describe, and organize data from these sources.

Furthermore, Haystack brings the important aspect of creating a semantic data approach that brings together Vocabulary (Tags data with descriptive words like air, fan, or unit), Classifications (Categorizes words used to define such things as equipment and locations and Relationships (Explains connections between equipment, such as how an air handle feeds a variable air volume system). Why is data modeling important? Because it standardizes the information contained within all the disparate building equipment and systems and enables the data to be made interoperable with each other. It also serves as a blueprint of how data is organized, stored, and accessed within a database or IDL (Independent Data Layer). It lays the foundation for efficient data management, accurate information retrieval, integrity, and effective communication between different stakeholders.

Here are some additional reasons:

- Organization: A data model defines the structure of the data in a clear and organized manner. It specifies data types, the relationship between the data elements and how they are grouped and stored. This organization simplifies the process of data entry and retrieval. It also reduces the opportunity for human error.
- Accuracy & Integrity: A well designed data model includes constraints and rules that help ensure integrity, reliability, and predictability. This means that the data stored within the database is accurate, consistent, and dependable.
- Efficiency: With a proper data model, databases can be optimized for efficient querying and access. The relationships and structure defined in a model help to minimize redundancy and provide a "framework" for generating queries that extract information quickly.
- Scalability: As data volumes grow, a well-designed data model allows for scalability. New data can be added without causing significant disruptions to the existing structure, and the database can be expanded to accommodate increasing data demands.
- Interoperability: The ability for multiple users across different job functions to look at data and quickly understand its source, structure, and what the model represents (like a pump or a production line). This context and metadata are what makes modeling important.

- Governance: Dictates how information should be shared across business units and mandates data uniformity. It also ensures only the appropriate systems and users who need access to that information receive the data and understand it. By modeling data with an abstraction layer dedicated to merging, modeling, and securely sharing data, we help ensure proper data governance.
- Consistency: A data model ensures consistency in data representation across the organization. This consistency is especially important in systems where multiple users or applications interact with the same dataset.
- Communication: A data model acts as a common language for different stakeholders, including business analysts, developers, and database administrators. It helps them understand the structure and meaning of the data, fostering better communication and collaboration.
- Reduced Redundancy: By defining relationships between data entities, a data model can help reduce data redundancy. Redundant data can lead to inconsistencies and inefficiencies, and a welldesigned data model minimizes this issue.
- Data Security: A data model can also play a role in data security. Access controls, permissions, and encryption strategies can be integrated into the data model to ensure that sensitive information is guarded from unauthorized access.
- Adaptability: When changes in business requirements or processes occur, a data model provides a foundation for making modifications to the database structure. This adaptability reduces the impact of changes on the overall system.
- Documentation: A data model serves as documentation for the database structure. This documentation becomes essential for maintaining, updating, and troubleshooting the database overtime.

In summary, a data model is not and should not be complicated. It is crucial for ensuring that data is organized, accurate, and accessible in a way that aligns with the needs of the organization. It provides a framework for efficient data management, effective communication, and reliable decision-making. Investing time and effort in designing and maintaining a robust data model can lead to improved overall data quality and performance. Data empowers companies to seek and make good fact-based decisions that drive better outcomes. Data modeling and Project Haystack provides numerous benefits, including increased efficiency, improved accuracy, reduced errors, cost savings, better insights, and increased agility.



Marc Petock is Executive Secretary on the Board of Project Haystack and Chief Marketing & Communications Officer at Lynxspring, Inc. Lynxspring is a Founding Member of Project Haystack and leading developer and manufacturer of smart building technologies and solutions.

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Generative Al Needs Tagging

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You don't have to convince anyone involved in tagging operational data that JSON dictionaries are serious business. However, Al Prompt Engineer Riley Goodside famously reported that "Google Bard is a bit stubborn in its refusal to return clean json." So, he threatened the chatbot that if it didn't return simple JSON name-and-value results without extraneous text "an innocent man will die." That seemed to work for him, and it is a good anecdote for describing where Generative Al technology stands today, with Natural Language Processing and Large Language Models like Google Bard being just one branch. It is a technology evolving at amazing speed, but you wouldn't really want to stake human lives on it yet. We are so early in the evolution of generative AI and large-language models that we need a 'Prompt Engineer' to make them work the way we want them to.

Building management and control algorithms deployed today at the whole-building, whole-campus, and wholeportfolio levels are largely custom engineered systems too. However, any technology that survives the test of time is eventually commoditized. Two trends enabling the slow but inevitable push toward commoditization of Machine-Learning and AI in building control automation are scalable cloud solutions and standardized point tagging.



Figure 1. Objects in the Niagara dictionary and the Haystack dictionary have the two-key 'name' and 'value' format typical of JSON dictionaries. This is code observed by the Grafana monitoring platform capturing a demonstration upload of model data moved by Niagara Data Service from a Niagara 4 Station to the cloud.

As a member of Project Haystack, Tridium recognizes the great value the organization and its specified ontology provides to the market. Niagara Cloud Suite™ and Niagara Data Service™ were developed to further unlock access to telemetry data enriched with Haystack tagging, as well as tagging from other industry-standard and custom tag dictionaries. More facility managers, system integrators and energy management service providers will adopt standardized tagging approaches when the investment they make in tagging is preserved and leveraged by many stakeholders and over a long period of time in a stable, secure, and scalable cloud environment.

When points are effectively tagged a picture of the realtime performance of a whole building or portfolio can emerge via data analytics. Of course, 'effective' tagging starts with the customer standardizing on an operationaldata strategy and architecture. Project Haystack was the first community of taggers to awaken building owners and operators to thinking about this, and today they are joined by Brick schema, RealEstateCore and ASHRAE 223 communities.

The Haystack 4 tag dictionary introduced in Niagara 4.13 generates tags, tag groups, relations, and tag rules directly from Project Haystack tag definition files. These tags are updatable in-place as Project Haystack issues new releases. Read about Niagara's Haystack 4 tagging support in the September 2022 edition of Haystack Connections starting on page 16. Niagara users are prompted to pull from both the Haystack 4 tag dictionary and the Niagara dictionary when tagging points. As you can see in Figure 2 when tags are applied, a Niagara Data Service query of a model database will return semantic model information about point values.

System integrators and other Niagara users will also tag with names that come from custom dictionaries that are specific to the project. For example, if the project is a controls retrofit for a hospital building (International Building Code: Occupancy Category I-2), a custom dictionary might contain tags pertaining to healthcode-related ventilation and air pressure requirements in surgery centers and burn units. Large education campuses and corporations likewise have custom dictionaries listing their naming schemes, for example, office zones, group meeting rooms and food service spaces. Equipment manufacturers are another source of custom tag dictionaries that can be pulled into Niagara Framework. Niagara, 4.14 is being built with more robust support for import/export of such custom dictionaries, as well as with support for other standard dictionaries like Brick schema.



Figure 2. Niagara Data Service subscribers can query their model database by point name, by tag name and by tag value. The results returned are items in the model database that match the query and include the cloud ID (referenced in the telemetry database of time series data), the systemGuid of the containing system, the display name, and any tags.



Figure 3. Niagara users pull tags from a range of Custom Dictionaries as well as from standard dictionaries like Haystack. The JSON objects rendered here are just imagined tag ID's and tag values. But the efforts toward semantic tags to represent the operation of VRF and lighting systems as well as other services in a building are real and evolving fast.

Won't Generative AI bots just solve this point tagging issue?

There is promising work in areas like using Natural Language Processing (NLP) to infer relationships between entities in buildings by extracting text directly from BIM models and auto-creating knowledge graphs. However, experiments of this type still run into the problem of irregular naming of HVAC, lighting, power system, access control, etc. A next step is to use NLP to align extracted entity names with ontologies like Haystack and Brick. However, working with pre-trained models still requires mostly manual work. Of course, massive energy and interest in Large Language Models (LLP) and generative Al on the part of companies like OpenAl (Chat GPT) and countries like China (Ernie Bot) is spurring hyper-fast innovation cycles. By all public accounts, generative Al is going to significantly leverage the work of our semantic tagging communities, not replace it.

Likewise, for the foreseeable future, the systems integrators and energy management consultants that do the work of tagging control points can look forward to having some awesome AI assistance very soon. However, an AI won't be eliminating their role in the near term, and even AI Chatbot Prompt Engineers like **Riley Goodside** have some runway before their jobs go away.



Therese Sullivan is Director of Customer Marketing at Tridium and a key member of the Niagara Product team. She is responsible for message strategy and content development for the Niagara brand and for nurturing the growth, enthusiasm, and cohesiveness of the Niagara Community.

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Features and Benefits

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Reductions in Energy Consumption through data-driven optimization that monitors and controls air distribution equipment without disruption to tenants

Sparkplug: Advancing Open Connectivity Solutions from Device to Enterprise

Sparkplug is an open-source software specification that provides MQTT clients the framework to seamlessly integrate data from their applications, sensors, devices, and gateways within the MQTT infrastructure in a bi-directional and interoperable way.



CI-SparkplugB Niagara Driver

Single Source of Truth: Configure process variables one time at the source and deploy to the entire enterprise

Decoupled Data: No longer maintain custom connections between various data sources

Immediate Discovery: New machine and sensor data becomes immediately available to all subscribers

Inherited Security: Leverages TLS for data transport and requires no open port for edge network devices

State Awareness: Birth and death certificates provide subscribing clients confidence in data validity

Haystack Compatible: Full support for Haystack tagging in Niagara





Find out more at conserveitiot.com



How AI Chatbots and Digital Twins are Merging to Shape the Future of Smart Buildings



We are stepping into an era of intelligent building infrastructure where buildings are not just inanimate structures but autonomous entities that interact, learn, and adapt to their environment. Digital twins bridge the physical world with the digital world and bring the promise of encapsulating real-time IoT data and physics-based thermal models under a unified framework. Yet, the Iack of standardization across digital twins, even within a single portfolio, makes it extremely difficult to offer ubiquitous out-of-the-box BMS solutions and hinders seamless integration. Tailor-made in-house solutions may work for highly specialized use cases such as Fault Detection and Diagnostics (FDD), but are not reusable across different domains.

Hayloft: The Haystack-Native Imperative of Standardization

The Haystack standard was introduced in 2014 to bring order to the chaos of building ontologies, or a lack thereof. Fast forward to today, we are seeing encouraging progress in the spirit of standardization and ontological alignment.

What comes next? Let us explore a common situation in building management today.

You are a system integrator tasked with retrofitting a building from the 1950s. How do you model the disparate components of the HVAC systems, including several boilers and some semi-recent VAV terminal units? How do you ensure the 1000s of sensor and control data points are properly tagged in such a way as to leverage existing ETL pipelines and data analytics? How do you also empower the integrator – who may not necessarily be a master of Haystack's ontological concepts – to still create standardized digital layouts that conform to modern industry guidelines?

75F's Hayloft, the industry's first open-access platform for building rich digital-twin models, tackles this challenge by offering a wide range of rich, community-maintained equipment models that extend from core Haystack 4 definitions. For example, Building-A-Zone-1-VAV-9000 is not a VAV because it was named as such; it is a VAV by virtue of it implementing a VAV model specification that contains a specific set of sensory and control points and sub-equipment describing the ductwork, each of which is described by well-defined Haystack tags.

Ensuring these digital twins have consistent ontologies and are tagged appropriately is one part of the solution. To exemplify this, consider a recent initiative that has grabbed smart building headlines. NEOM's The Line boasts an ambitious construction project, spanning 110 miles and housing 9 million residents (about half the population of New York). This will be a cognitive city, which means data gathered from the environment, equipment and its occupants will be processed and analyzed to optimize the entire city's operations in real time. While automation will handle many routine tasks, human expertise remains irreplaceable for mission-critical operations. As of September 2023, The Line was projected to require 2,800 full-time facility-managers.

So how do we leverage the promise of semantic modeling paradigms such as Haystack and BRICK to do scalable facility management? While the intricate purpose-built user-interfaces of today may work seamlessly for an experienced administrator, this may no longer be the preferred solution for the everyday user. How do you empower building managers of small-to-mid-sized buildings to control a thousand more? The answer could lie in something that has existed for almost as long as we have: natural language.



Figure 1. Streaming consistent data from buildings as a base for all NLP-based interactions.

The Revolution of Chat-Based Interfaces

With the advent of powerful Large-Language models (LLMs), IoT companies now have the opportunity to make state-of-the-art Natural Language Processing (NLP) technologies finally accessible to their end-users.

Imagine a scenario where, instead of adjusting a thermostat or checking an app, you simply ask your building, "What is the IAQ today?" or instruct it to maintain a temperature of 72°F in the conference room. This seamless interaction is made possible by conversational chat agents. Similar attempts have been made to bring this core technology into the mainstream but failed to be executed as effectively. The key was finding an interface paradigm – natural language – that allowed humans to interact intuitively with powerful AI.

Popular publicly available AI chat offerings today only hint at the transformative impact to come as interfaces evolve from rigid menus to intuitive, adaptive conversations. This has profound implications for design patterns, data architecture and personalization underlying BMS interfaces today.

We at 75F believe this is a true game changer in building intelligence. At the heart of this evolution lies conversational AI assistants and digital twins working in harmony to make building stakeholders more efficient and more informed using trustworthy data. Conversational agents can unify the control of various sub-systems, from lighting to elevators to security to rodent-repellent systems, providing centralized command through simple dialogue. These agents can summarize and extract insights from vast amounts of data, enabling managers to make informed decisions quickly. The confluence of these two technologies is set to redefine our interaction with built spaces.

Let us now examine how the conversational agents powered by language-models promise to reshape the future of smart-buildings and remote facility management.

Adaptive Learning: The NLI can learn from interactions and improve over time. For instance, if a user frequently asks for the room temperature to be set to a specific level at a certain time, the system can proactively suggest or even implement this setting in the future. User-modeling techniques can track preferences and behaviors over time to offer customized experiences. Interfaces may simplify workflows for the novice facility manager or the experienced energy manager.

User-Friendly Interaction: Facility-managers won't need to navigate through complex menus or learn specific scheduling or setpoint-management sequences. They can

simply ask or instruct the building using natural language, making the system more accessible to a broader range of users, including those who may not be tech-savvy or just want to get the job done and move on. These systems can integrate multilingual support, accommodating a diverse group of users. Additionally, voice-activated NLIs could allow for hands-free operation, enabling users to multitask effectively.

Contextual Understanding: Instead of users manually inputting data or selecting from pre-defined options, they can make requests like "It feels a bit chilly in here" and the system can respond by adjusting the temperature accordingly. Rather than navigating multiple screens, users can convey complex instructions in a single sentence. For example, "Prepare the meeting room on the 5th floor for a presentation at 3PM" can trigger a series of actions like booking the room, adjusting lighting, and turning on presentation equipment.

Intuitive Real-time Troubleshooting: If something isn't working correctly, users can simply describe the issue in their own words. For instance, "The lights in the hallway seem too dim" can prompt the system to check and rectify the lighting situation. In case of emergencies or sudden issues, they can ask, "Why is the fire alarm going off in Building D?" to get immediate insights without sifting through logs.



Figure 2. The ability to explore, act, and analyze faster and easier is core to Saffron AI's purpose. The prompts shown here are just a few examples of the powerful interactions users can have with Saffron AI.

Saffron Al

When we set out to build Saffron, our most recent humancentric AI platform, the above were key requirements that were core to its development. Its technical feasibility is underpinned by the incredible effort that was required to lay the groundwork for making rich and consistent data models ubiquitous within the ecosystem. With a standardized ontological schema for digital twins, AI agents are finally unhindered to integrate with diverse building sub-systems, irrespective of the manufacturer, model or scale. As facility managers handle multiple buildings, striving for standardization also ensures the design and implementation of AI agents can quickly be adapted to another with minimal tweaks. Building IoT data is made accessible for data acquisition and analytics, while also leveraging anonymization and encryption mechanisms to guarantee the sovereignty and privacy of all customer data. Saffron not only leverages the current 75F software platform to execute complex workflows via a natural language interface, but it also employs a multi-modal paradigm that allows it to see, hear and understand the human user. Rather than replacing the human touch, we



Figure 3. Saffron AI is capable of highly personable interactions so user experiences are approachable and useful.

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Yes, your CCUs are up to date. The current CCU version on all floors i	s 1.642.6, which is also the	recommen	ided version	
Ask me anything			Q	,

Figure 4. Saffron AI uses real-time and historical building data to give users accurate and actionable information their buildings.

believe this puts the human at the center, more in control of their data, and will make them ever more effective at managing their buildings and extracting actionable insights.

Final Thoughts

Looking ahead, we are confident the current BMS user interface as we know it will disappear. The fusion of smart

buildings and conversational agents will herald a new age in facility management and portfolio analytics. However, for these AI agents to be truly effective assistants, the underlying infrastructure needs to speak a common language. Through the standardization of data models and purpose-built the standardization of data models and purpose-built the standardization of data models becomes not



Madhu Tennakoon is Head of AI at 75F and a key since 2017. He has been instrumental in building of ML platforms, including the recently launched Saffron driven applications aimed at optimizing user comfort and



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- Easy maintenance
- For single or multiple sites
- Integrate lighting, heating, VRF, energy and more
- Mini Facility Manager application with simple dashboards
- Easy and secure remote access option, without requiring VPN, using FIN Edge2Cloud.

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Using Natural Language Query to Interact With BMS

CONEXAO TECHNOLOGY SOLUTIONS

O-Insights[™] **Genie** is a search-based analytics application for the Niagara Framework[®] that uses Natural Language query to interact with its users. It helps in providing immediate responses to questions for automation systems. Genie's objective is to acquire Business Intelligence from BMS systems in a swift and facile manner, consequently empowering the users of the BMS.

Natural Language Processing (NLP) is how machines can understand human language as it is written or spoken and thus provides a very intelligent and efficient way of communication. A simple way to break down the steps of NLP would be 1- Recognize the words typed/said in the sentence. 2- After recognizing words, construct the meaning of the words in the language the machine understands. 3- Interpret the sentence and provide results to the user. Project Haystack helps to standardize the way semantic tagging and data-modelling is used in BMS systems. With Haystack giving meaning to points/tags in automation systems, we can now get the context for the data points irrespective of the way the point names were created.

There could be many ways an AHU point can be named. For instance, temperature point for AHU 21 serving Room 201 could be created as AHU21_RmT201 or AHU21_RmTemp201 or AHU21_RoomT_201 or AHU21_ MR201_Temp...... but how do we standardize what this point referrers to? That's where project Haystack allows standard tags to be assigned to points (Meta data) to allow easy exchange of information between systems. So, in this example by tagging the point with hs:ahu (AHU tag) indicating that this point belongs to an AHU and relating all points that belong to an AHU using relationships, we can set the context. By this objectification of point data using Haystack, any consumer of BMS data with these tags can identify AHU points and make decisions based on its various properties.

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Figure 2. Any consumer of BMS data with these tags can identify AHU points and make decisions based on its various properties.

With the growing adoption of Project Haystack tagging of BMS systems by System integrators, the time taken for Applications to understand the system and start consuming the data, is very little.

One of the focus points of Genie has been to circumvent how anybody with zero knowledge of BMS systems can interact effectively and productively with a BMS. Presently, we use Google to search for requisite information available on the internet or LinkedIn to search for professional contacts and friends. Genie brings the same experience to Buildings and Smart Cities. It uses Haystack to understand what the user is looking for. For instance, if the user wants to know the temperature of all VAVs that have a value greater than 24 degrees Celsius, Haystack will help Genie identify the VAV temperature points to provide an answer.



Figure 3. Genie's User Interface where a user can type/speak what they are searching for.

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With a lot of focus on Alarm Management, Genie can help answer various questions a user has with respect to the alarms, like the total number of alarms in a specific area that are currently open, breakup of alarms by type etc. Genie being a BI tool also displays the information rendered as graphs/ pie charts/ tables, among others. Genie can also pull up graphics pages on request like "Show me the graphics for Sustainability". A big advantage is the time saved for creating dashboards, which often runs into days or weeks. Questions can now be asked in English to fetch answers with appropriate visualizations for each business use case for which dashboards need to be created. Queries can be saved and can be called up whenever required. As users interact with Genie and provide feedback, it learns and keeps enhancing with time. For systems which have minimal or no tagging, O-Insights also provides a tool for bulk tagging. A simple CSV list of hundreds or thousands of points in multiple groups can be tagged in one go.

In conclusion, Genie provides swift access to information in your BMS without any software knowledge, which enables improved data driven decisions for your organization.



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Reshaping Systems Integration - Ingesting and Acting On Site Data at Scale Using Standard Templatized Digital Twins



magine a world where building site management becomes seamless, efficient, and intuitive. This is no longer a dream, but a tangible reality with the advent of digital twins hosted in an industry standard repository. These standardized models revolutionize the way equipment is commissioned within building spaces. By utilizing these templates, the setup and configuration of buildings become a breeze.

Digital Twins, Standardized Equipment Data Models, and Site Manager: The World Without Them

Any existing BMS/BAS and its various integrations within the smart buildings space plays a vital role in ensuring efficient and effective operation, and addressing all the integration concerns is crucial to maintaining a comfortable and secure building environment for the occupants while optimizing energy use.

Considering the market space of building controls and various OEM technologies currently present, having an integrated system comes with its own challenges. Even with all the advancements in technology that exist, facility managers and operators continue to face many issues day in and day out, and having an out-of-the-box solution to ensure their BIS functions as intended is a tedious task they continue to undertake. This is true even to this day with all the advancement in various OEM integration options we have seen.



Figure 1. CDifferent data perspectives among too many different vendors can cause chaos in any systems integration project.

A typical systems integration job path currently is paved with these challenges:

- Connecting to Monolithic Systems
 - Legacy monolithic systems are often deeply ingrained in an organization's operations, and it can be challenging to integrate modern applications with them due to their tightly woven architecture. The integration process must be carefully planned to avoid disrupting critical business processes.
- Different Data Perspectives:
 - Business units within an enterprise may have their unique perspectives on data and may use different systems or applications. To achieve effective integration, a standard data model is essential. This involves defining a minimum canonical data model that all systems can adhere to, facilitating seamless data exchange.
- Balancing Speed and Quality:
 - IT projects are often under pressure to deliver quickly and within budget. This can sometimes lead to compromises on architectural best

practices. A system integrator must strike a balance between meeting immediate functional requirements and considering long-term nonfunctional aspects like performance, scalability, and maintainability.

- Choosing the Right Integration Tools:
 - The market offers numerous integration tools, each with its unique features and capabilities. Selecting the right tool for an enterprise can be challenging. Hybrid integration tools, which facilitate the seamless connection between on-premises and cloud-based applications, are essential for modern enterprises.
- The Integration Challenge:
 - It is challenging for organizations to integrate BMS products from different vendors, especially if already heavily invested in one vendor's stack. They should choose products aligned with their BMS vision and integration needs to allow true flexibility and interoperability. In this journey, the stakeholders need to be cautious of several problems:

- Vendor Lock-In: Choosing a single vendor's stack of products can lead to vendor lock-in, where an organization becomes heavily dependent on that vendor's technology and solutions. This can limit flexibility and hinder the ability to adopt innovative solutions from other vendors.
- Complexity and Inefficiency: Mixing products from different vendors can lead to complex and inefficient systems. These systems might not work seamlessly together, resulting in additional development effort, higher maintenance costs, and potentially reduced performance.
- Lack of Best-of-Breed Solutions: Some vendors excel in certain areas and lag in others. By committing exclusively to one vendor, organizations might miss out on best-of-breed solutions in particular domains. For example, a

company might choose a vendor for its excellent remote-control technology of HVAC but miss out on a better lighting solution from another provider.

- Incompatibility: Different vendors may use different standards, protocols, or technologies. This can lead to integration challenges when trying to make these systems work together. Interoperability issues may arise, making data exchange and communication difficult.
- Scalability Concerns: As businesses grow, their technology needs often change. If a vendor's product stack doesn't scale well or isn't adaptable to evolving requirements, organizations can face limitations in their expansion plans.



No Unified Repository

Custom models live in multiple places, unknown to others.



No Keeping Track

Until now, there's been no easy way to keep track of evolving models.



No Universal Experts

Not every organization has Project Haystack experts on hand.

Figure 2. A high-level summary of the challenges of a typical systems integration job.

Why do we need a Standard Templatized Consistent Data Story in Integration and a Tool Like Site Manager to Ingest it?

Standardizing data in Building Management Systems (BMS) across various Original Equipment Manufacturers (OEMs) is a challenging but essential goal to achieve interoperability and seamless data sharing in this building space. With templatized Digital Twin databases coming in with tools like Hayloft, maintaining data standards and integrity becomes easy and essential.

Hayloft — based on the amazing tagging system that Project Haystack provides — allows for data ontology that defines the meaning and relationships of data points defined at an equip modelling level. This makes it easier for different systems to understand and interpret the data correctly. Hayloft offers a repository for version control digital twins of HVAC equipment from various manufacturers. This is extended to incorporate the actual protocol specific information required to communicate with the devices including Modbus specific registers or object-ids in the case of BACnet.

Hayloft defines Clear Data Standards and establishes an Open system that can be used and shared across a community of Users for tagged data and can be used across various buildings' data modelling scope. It implements open communication with data model sharing that can be supported by various OEMs.



Figure 3. To maintain data integrity, 75F uses standardized tagging across all equipment in its full-stack solution.

Hayloft-based data management has various stages and parts to it. As specified below, we can see how the metadata management plays an important role in enabling all its functions.



Figure 4. Metadata is part of a larger landscape.

75F Hayloft Data Governance Framework

A typical data governance framework requires an effective lifecycle through strategy and formulating the right processes in data authoring to data usage. Putting together an effective mechanism for monitoring and control is equally important as data governance is a journey and not a one-time initiative. Hayloft authors, users, and reviewers typically need to remain invested in data governance initiatives with focus on different equipment modelling, tag usage, and regulatory imperatives.



Figure 5. 75F Hayloft Data Governance Framework illustration.

- Master and Reference shared data management:
 - This creates common data models and templates for any buildings' equipment to be authored. It provides a space for maintaining and tracing versions of equipment types that have been modelled. When a community of OEMs adheres to these tagging and modeling standards, their data is structured consistently, which reduces modelling across a multitude of buildings.
- Metadata management with data tagging and mapping:
 - This step involves developing a data mapping or translation layer that can convert data from various OEM-specific formats to a standardized tagged format. This data layer acts as a common data-sharing bridge between different vendor systems.
- Data Validation:
 - Establish data validation procedures to ensure that data received from different OEMs complies with the standardized format and quality requirements.
- Data Quality:
 - Vendor collaboration with various OEMs and involving them in the standardization process.
 Seeks their input and feedback to ensure the standards are practical and can be implemented in their systems.
- Data Stewardship:
 - Allows for Regular Audits and Updates with accurate history check and versioning. Enables peer reviews of all tags, points and modelled equips to be normalized as a central repository so that all equips can be reused across the community across any building deployments. Allows for conducting regular audits to verify that data from different OEMs adheres to the standards. Update the standards as necessary to accommodate evolving technology and industry changes.

- Data and Information Lifecycle Governance:
 - Allows for easy data governance practices to maintain data consistency, quality, and compliance with standards of tagging and points across the same equipment across any usage within various buildings.
- Metadata Management with compliance with Haystack and other Industry Standards:
 - Ensures the data standards established for your BMS align with relevant industry standards, codes, and regulations.

Standardizing data in BMS across various OEMs is a complex but worthwhile endeavor that promotes interoperability, data consistency, and efficient building management. By following these strategies, we can work toward achieving a more integrated and streamlined BMS environment as a community.

How Site Manager Helps a System Integrator

Having a cutting-edge tool like Site Manager helps revolutionize the way buildings' site management and systems integration is approached. Site Manager facilitates a seamless and efficient process that allows the ingestion of site data at scale, standardized equipment commissioning, and easy building ontology instantiation.

Site Manager facilitates the ingestion of tagged and versioned digital twins. It allows for the effortless integration of these digital twins, ensuring that the data is accurately represented within the building ontology. These standardized models simplify data management and ensure uniformity across different sites.

Site Manager allows for easier, and more efficient equipment commissioning. Data modelling of each equipment in Hayloft with accurate tagged data and their sharing and usage among a community of System Integrators revolutionizes the equipment management of building spaces. The use of templates makes it straightforward to configure and set up HVAC equipment from various manufacturers for each Site using Site Manager.



Figure 6. Site Manager is the center of data integration.

Site Manager becomes the center of system integration that allows various modelled equipment to come together under one building under one platform. It can allow for integrations happening from an API integrator, a MODBUS-based data pump, a BACnet system or even a JACE-based system pumping in equipment data. Site Manager leverages Hayloft's repository for versioncontrolled digital twins of HVAC equipment and enhances interoperability within a building. By including protocolspecific details like Modbus registers and BACnet object-ids, it enables different equipment types and their supported protocols to communicate seamlessly within a building management system.



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How XETO Will Supercharge the Haystack Ecosystem



ew understand the value of building and building system metadata better than the Haystack community. Metadata helps to identify and organize the various input and output data streams that sense and control a building, label the relationships between them, and develop and configure applications to analyze the data, act on it, and optimize building operations. By making building system configuration information both explicit and standardized, metadata makes Energy Management Information Systems (EMIS) software easier to install and maintain, reducing the cost of ownership of EMIS and leading to greater adoption of EMIS and EMIS applications.

Today, metadata reduces the manual EMIS software installation, configuration, and integration effort. In the future, it could virtually eliminate this effort as EMIS software develops the capability to parse, guery, and traverse metadata and configure itself to individual installations. Getting to this point will require that metadata become even more standardized than it is today. Today's metadata is standardized in terms of syntax and enumerations. That is sufficient to help human installers. To support installer automation, metadata will also need to be standardized in terms of structure (i.e., objects and their links used to represent different systems) and content (i.e., the minimum information that must be present). Automated software installation and configuration is greatly simplified if the software can count on the necessary information always being present and always being in the same place.

Until recently, Haystack did not have a facility for programmatically checking and enforcing model structure

and content. However, a new set of capabilities released earlier this year and formally announced at the Haystack Connect conference in June addresses this gap and promises to bring this next level of standardization, automation, and value to the Haystack community. The new capability is called XETO (short for Extensible Type Objects pronounced ZEH-tow) and is being developed by Project Haystack as part of a three-year competitive award from the Department of Energy's (DoE) Building Technologies Office (BTO). XETO is part type system, part template system, part query language, and part API (application programming interface). The various pieces of XETO can be combined to create workflows for specifying structural and content requirements for Haystack models, checking that Haystack models conform to specifications, and even fixing non-conforming models.

XETO builds on two new features. The first feature is a type specification or "spec" for short. A spec looks like a class declaration in an object-oriented language like C++ or Java. It contains the names of the fields in the object and their types. As in other languages, specs can inherit from other specs and extend them, (e.g., the ElectricityMeter spec inherits from the Meter spec and adds the "elec" tag). Type specs are a central feature of object-oriented languages which require that objects be created as instances of type specs. However, Type specs are new to Haystack and a lot of existing code would break if type spec-based object creation became a new requirement. Instead, XETO provides a "fits" function for checking whether a given Haystack object structurally conforms to a spec (i.e., it has the same fields of the same type). Helpfully, XETO also provides a "fitsExplain" function which lists which tags and fields must be added to the object before it conforms to the spec.

Validating models takes more than validating the individual objects, the links between the objects must also be validated. In XETO, this is accomplished by defining type spec fields that correspond to object links (e.g., "equipRef" fields) as queries for finding objects of the appropriate type. These queries can be executed using the "query" function, making it possible to check whether the link references a valid object. Queries are transitive (i.e., they can find objects through multiple link hops) and can be invoked bi-directionally (i.e., they can be used locate both linked-to objects and linked-from objects).

The combination of type specs, queries, and several key functions allows installers and integrators to systematically traverse model specifications, ensure that all expected objects are present and contain all the required fields, verify that objects are properly linked to one another, and fix any omissions, errors, and ambiguities. In theory, it allows software to perform the same systematic checks (and ultimately (perhaps) even the same human judgement-based fixes).

XETO will make it easier to create robust and complete Haystack models which will makes EMIS software easier to install and update. But as with metadata itself, it has the potential to help the EMIS industry at large. Today, Haystack models are developed and updated incrementally during EMIS application installation according to the needs of those applications. This process prevents applications from installing themselves automatically. XETO allows the activities of metadata model development and EMIS application installation to be decoupled. Specifically, XETO allows application vendors to publish specs for metadata models that can support their applications. Building owners can procure metadata models that conform to these published specs so that when the application is eventually installed the information it needs is there. The application itself is not

needed to verify the correctness and completeness of the model, the XETO spec is sufficient for that purpose. Over time, specs from different vendors are likely to coalesce either organically or intentionally via a standardization process—into specs that cover entire EMIS application classes, increasing inter-operability and further simplifying the process of procuring both metadata models and EMIS applications.

XETO will not automate away the job of master system integrators, although it is likely to change the mix of tasks, the amount of time spent on each installation, the quality of the modeling, and the total number of installations that an integrator can complete. Installing and configuring EMIS applications will play a smaller role while metadata model creation will play a larger one and could conceivably become a standalone service of its own. Taking one step back, XETO promises to help the entire EMIS pie to grow.

If you are in the metadata world, you have probably heard the terms "semantic metadata" or "semantic modeling" or the names Brick Schema or ASHRAE Standard 223P. Semantic metadata is metadata that is based on the Semantic Web technology stack, RDF (Resource Descriptor Framework), SPARQL (Standard Protocol and RDF Query Language), and the SHACL (Shape Constraint Language) metadata schema. Brick and ASHRAE 223P are semantic metadata schemas for buildings and building systems. ASHRAE 223P is a low-level verbose schema that can be used to define schemas at higher levels of abstraction. Brick is a higher-level object-oriented schema. Type specifications are built into RDF while SPARQL provides query functionality. SHACL supports model validation. People are excited about semantic models because they see the benefits that model validation and queries can have for EMIS and the EMIS industry. XETO brings similar capabilities and benefits as the RDF/SPARQL/SHACL technology stack, but in a form that should be more familiar to the well-established Haystack community.



Dr. Amir Roth is a technology manager in DoE's Building Technologies Office where he works on building energy modeling, large-scale analysis, and building controls. He has been the technology manager for all three DoEsponsored semantic modeling projects: Brick Schema, ASHRAE Standard 223P, and the current Project Haystack effort behind XETO.



Reducing Carbon Emissions With the Use of Haystack Tagging

J2INNOV/TIONS A Siemens Company

There's a significant but underserved segment of the market characterized by small square footage and low-complexity commercial buildings. Collectively, this segment represents up to 40% of commercial energy costs. These buildings require a non-traditional approach to BAS, much like we're seeing in the residential market with smart homes. The development of plug-n-play intelligent devices and software applications that "just work" out-of-the-box to reduce the installed cost of controls upgrades, will be essential if we are to achieve significant carbon reductions across the vast number of smaller commercial buildings.

The standardization of metadata offered by the widely accepted Project Haystack open standard enables smart devices to self-describe the data they generate, which enables configuration wizards to rapidly integrate multiple subsystems into a complete solution. Data format standardization is also vital to communicate building performance information northbound to cloud applications for use in managing such buildings remotely.

Small Building Market Opportunity

As smart devices continue to proliferate in our personal lives, we can now easily add thermostats, sensors, cameras, and other controls to our homes. This is raising our expectations for the way workplace environments operate. The segment of the commercial building market that includes small to medium-sized buildings is often called the "mid-market". Examples of these types of buildings include local government buildings, small offices, leisure sites, small retail and restaurant premises. The mid-market is long overdue to be fitted with more intelligent controls that better optimize energy use and assist with maintenance issues. Market penetration has traditionally been relatively low due to the cost and complexity of implementation. Innovative products, similar to those being developed for the smart home market, are needed to create cost-effective solutions for this midmarket segment, except that a more systems-oriented approach is needed since the smart home device market is currently far too fragmented and siloed.

Small Buildings Can Be Smart Too

Like in larger mid-market buildings, there are typically multiple subsystems, including air conditioning, heating, lighting, energy monitoring, solar, and more. There's a huge opportunity for building managers and owners to benefit from a unified building management system much like their larger building counterparts. Currently, most buildings have separate proprietary controls and management of each of these subsystems, with little or any data available remotely. There are multiple benefits to be gained from a more unified and connected approach. These include simplification of scheduling, more effective alerting of fault conditions to managers, more cost-effective occupancy-based control, and improved occupant comfort from improved temperature control. Overall the improvements in operational efficiency and reduction in energy costs can achieve a payback of 2 years or less in many cases. This has been proven by existing proprietary solutions that have been implemented with wireless devices when retrofitted into existing buildings, but solutions that can integrate a much broader range of

existing devices and protocols are necessary to achieve wider adoption.

Also essential, will be a simplification of the commissioning process. Drawing from the smart home analogy, an appliance approach that uses templates and wizards can greatly simplify the integration process. This out-of-the-box ,auto-configuring experience will make smarter solutions more attractive for contractors and installers. Software that can auto-generate simple dashboards, with easy-to-use applications for scheduling, alarming, and system control, as well as simplifying secure remote connectivity without the cost and complexity of setting-up VPNs, has the potential to revolutionize the way we manage mid-market buildings. This is not a pipe dream - the "next-generation" software developers such as J2 Innovations with the FIN Framework microBMS technology provides the basis for controls suppliers to deliver such solutions to the market today. Currently, very few control devices and subsystems fully self-describe the data they communicate, so templates can be quickly created to add the extra metadata so the system can self-configure when integrating existing subsystems or devices.

Small Buildings Can Be Plug-n-Play with Project Haystack

Ideally controls manufacturers need to include support for Project Haystack's standard in their future products so that when their device or system is connected to the IP network, it is automatically recognized by the overall site management software. Various companies providing IT infrastructure services for larger buildings are already proposing those specifications. They require that all connected services equipment complies with an open standard for semantic tagging and data modelling, like Project Haystack, to simplify the integration process.

Specifying an open protocol such as BACnet or KNX is insufficient because skilled engineering time is still required to make such systems work. For smaller buildings, this cost completely blocks the deployment of smarter integrated systems because the contractor channels can only cope with a much simpler "1,2,3" step-wise approach to commissioning. Adoption of Haystack by equipment manufacturers would massively help in the mid-market segment, even if only at the level of documenting the data tags required for their specific equipment item, since this would make template creation in the management software much easier. This new approach helps software applications to dynamically "learn" smart devices and utilize their data. Through the self-describing nature of the metadata, the "meaning" of the connected devices can be interpreted and automatically generate content, such as the dashboards mentioned earlier.

If the templates for each connected device or subsystem include a responsive web graphic, the user experience can be automatically made available on a phone or tablet, which matters since this is how managers want to be able to interact with their buildings. Through the use of tags and their relationships, dashboards are dynamically generated. Tags can also be utilized to automatically bind device data to control routines. Project Haystack enables this "just works" functionality that is so badly needed for the mid-market.

Small Smart Buildings Can Be Connected Too

As more and more small- to mid-sized buildings become integrated and intelligent, getting them connected can bring additional value. Similar to the residential analogy that utilizes IoT to connect your smart devices to the cloud, this technology can now be applied to connecting smart buildings. Through the use of open protocols such as MQTT and Haystack, the full value of mid-market, big data can be realized.

In summary, by taking an appliance approach and leveraging Project Haystack, the control and management solutions for mid-market buildings can be transformed to provide easy to deploy, securely connected, user-friendly solutions that can help us all contribute to reducing carbon emissions and avoiding wasteful use of energy.



Scott joined J2 Innovations as a partner in 2011 and is now Vice President of Customer Experience. His responsibilities include evangelism, business development, training, and operational excellence. Het is an industry expert in smart homes and smart buildings. He is a past president of ASHRAE and is currently an associate board member of Project Haystack.

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EVSE Working Group Update

V charging within the built environment has become a popular topic within the Smart Building and EV Charging industries. Project Haystack clearly plays an important role of enabling cross industry collaboration to facilitate faster and smarter electrification and decarbonization.

The EVSE working group has been hard at work developing Project Haystack defined EVSE data models. We would like to thank Stephen Frank who recently gave a wellreceived presentation on behalf of the working group at Haystack Connect 2023 referenced in this link: www.nrel.gov/docs/fy23osti/86366.pdf.



We have expanded the working group's effort to address gaps in Project Haystack models for electric power systems. This work will improve data models used in data center, EV charging, and other behind-the-meter applications. Also, we are collaborating with the Labs working group to define attributes related to EV charging service operations.

In the near term, we plan to improve the related Project Haystack documentation based on recent progress and to continue improving based on market feedback. Stay tuned for future updates!

Find our Working Group #982 at: www.project-haystack.org/forum/wg. 💥



Rick Jennings, PE, CEM, is a Data Analytics Application Engineer at SkyFoundry and has over 10 years of electric power engineering experience involving nuclear propulsion systems, traction converters used in rail vehicles, data centers, and electric vehicle charging infrastructure.



BIM/Haystack Working Group Update

This year, we embarked on the journey of reestablishing a Working Group dedicated to aligning BIM with Project Haystack. We recognized a recurring challenge: the redundant generation of data and information from design through construction and commissioning, ultimately inflating the total cost of ownership. This redundancy necessitated a labor-intensive process of data mapping before we could unlock its full potential.

To address this issue, we've embraced a pragmatic approach, leveraging ontology-based metadata schemas to streamline the analysis, visualization, and extraction of value from our design and operational data. Our primary focus is bridging common BIM IFC classes with the Haystack convention, empowering Haystack to work seamlessly with BIM data. The formation of this working group signifies a pivotal moment. It aims to revolutionize the integration of Haystack data modeling with the BIM standard, simplifying the transition of critical facility data from the design, retrofit, and construction phases to the operational phase of a building's life.

Our journey officially commenced this summer, marked by our inaugural meeting in September.

I am leading Project Haystack Working Group #1071: BIM/Haystack and welcome everyone to join the cause and help towards the harmonization of BIM and Project Haystack.

Find our Working Group #1071 at: www.project-haystack.org/forum/wg 💥



Georgios Grigoriou is a Digital Building Engineer at Buro Happold. He specializes in Digital Twins, IoT & BMS Data Solutions for the Built Environment, with a demonstrated history in energy efficiency, smart buildings, and renewable energy projects.



Machine Learning Working Group Update

am happy to report that Project Haystack has reached a significant milestone with the publication of the inaugural Machine Learning Working Group's first draft. Shaped by extensive community input, this proposal strives to unify the approach to Machine Learning within the Haystack framework, reflecting a collaborative effort toward standardized advancements in smart building technologies." I am leading Project Haystack Working Group fo Machine Learning #1070. We welcome anyyone to join the cause and help towards the commericalizing Project Haystack.

Find our Working Group #1070 at: www.project-haystack.org/forum/wg 💥



Jan Široký is the leader of the Energy Twin team that is focused on the use of machine learning for energy and HVAC data analysis. He is working with semantic data in various practical applications such as HVAC fault detection or virtual power plant monitoring.





CLOCKWORKS ANALYTICS



Tagging initiatives are made official by launching a Working Group with a defined proposal and good visibility. Join a WG now!

WG	Торіс	Champion
#492	New Data Center Tag Working Group	Ron Snyder
#496	Lab/Fume Hood Working Group	Gabe Sandoval
#497	Chiller Plant Enhancements Working Group	Sean Stackhouse
#503	Access Security Working Group	Justin Tashker
#505	Refrigeration System Working Group	Nathan Rona
#506	Unitary Equipment Working Group	Eric Loew
#530	BIM/Haystack Working Group	Chris Renter
#595	Invitation to Project-Sandstar Working Group	Alper Üzmezler
#609	AHU Standing WG	Jay Herron
#667	Cybersecurity Working Group	F Gordy
#701	Data Center Tags	Jason Ganiatsas
#705	Lighting Systems WG	Jeremy Yon
#837	Haystack Labs Standing WG	Cory Mosiman
#916	VRF System WG	Yuya Saito
#982	Working Group for Level 2 AC and Level 3 DC EVSE	Rick Jennings

To learn more or to join a Working Group, visit https://project-haystack.org/forum/wg



Demand for Project Haystack participation is up at events around the world and community members have risen to the call.

AHR Expo 2024

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A tAHR Expo 2024, we celebrate the past 25 years and the promising future for the building controls and automation industry. AutomatedBuildings.com is committed to being your trusted source of information and innovation, helping you adapt to the rapidly evolving landscape. In this celebration session, we will present our plans for the future of AutomatedBuildings.com as we announce exciting plans to continue to serve as your central hub for the latest news and trends shaping the future of building automation. FREE to all registered AHR Expo attendees. https://ahr24.mapyourshow.com/8_0/ sessions/session-details.cfm?scheduleid=262 for more information.

Watch the Video Invitation: https://www.youtube.com/ watch?v=UszRf1wttq4&t=6s

Fun bit of our History together. Just a few Hayseeds in Chattanooga started a revolution in 2013: https:// www.tiki-toki.com/timeline/entry/1195904/20years-of-Back-issues-for-AutomatedBuildings. com/#vars!panel=11896207!'

https://www.automatedbuildings.com/body_jun13.html

https://www.automatedbuildings.com/news/aug15/ articles/bldgcntx/150728010202bldgcntx.html

First connection: https://www.automatedbuildings.com/ news/mar16/articles/bldgcntx/connections.html

Thanks to all for being such a big part of our history!





Project Haystack is proud to be a Supporter of the 2024 Building Commissioning & Energy Management Conference & Expo, a premier event in building commissioning, TAB and energy management.

The conference is presented by the Energy Management Association (EMA), AABC Commissioning Group (ACG) and the Associated Air Balance Council (AABC). CxEnergy 2024 offers pre-conference training & seminars, AIAapproved technical presentations with nationally recognized speakers, and the Expo Hall featuring the latest technology in the industry. Relationship-building opportunities allow your organization to interact with hundreds of attendees to get recognition in the industry and establish contacts with your peers.

Project Haystack members receive a 10% discount with promo code SUPPORTING10. Register at: https://www.cxenergy.com.

Recap

Kicking off Haystack Connect 2023 was the main plenary session, presented by the Co-Executive Directors of Project Haystack Richard McElhinney, Nick Gayeski and Alex Rohweder.

2023 Haystack Connect

Roger Quesnel, Executive Board Member, provided an update on the multi-year Buildings Energy Efficiency Frontiers & Innovation Technologies (BENEFIT) project, funded by the U.S. Department of Energy (DOE) Building Technologies Office (BTO). The project just hit its first milestone and is going well, with the initial creation of Xeto (eXtendable, Explicitly Typed Objects) technology.

Details about XETO were presented by Brian Frank, Technical Lead, Project Haystack and Jason Briggs, CEO, Novo Studios. Other compelling presentations during the event were:

- Andy Frank's talk on Ontologies and Independent Data Layers, "What an IDL is not." (We did a blog post about IDLs recently).
- Jessica Granderson from Lawrence Berkeley National Laboratory did a great job explaining "this technology is core to the future of buildings."
- Joseph Bohm, CEO of Dual Fuel Corp took us on a journey of how data analysis of boilers in New York City has made a successful business and company culture for his organization.
- Jeremy Wolfe, VP Sales Americas at J2 Innovations, walked us through the multiple stakeholders that contribute to specifying and implementing Haystack.

And, for those who may have missed conferences in the past, recorded presentations are available to view on **Vimeo**. Others are available on previous year Haystack Connect websites.











Past Haystack Connect Videos and Slide Presentations



Past Conference Websites

Haystack Connect 2013 Haystack Connect 2015 Haystack Connect 2017



Haystack Connect 2019 Haystack Connect 2021 Haystack Connect 2022 Haystack Connect 2023

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The Newest Associate Member Companies Joining the Mission



A lperia, a forward-thinking utility company based in Altaly, has carved a niche in the renewable energy sector, particularly within South Tyrol and Trentino regions. As a purveyor of green energy, Alperia excels in the generation, distribution, and retail of electricity, harnessing hydroelectric and solar power sources. The company is at the forefront of promoting sustainable practices and innovations, with significant investments in smart grids, energy-saving technologies, and electric mobility solutions.

Expanding on its suite of energy-efficient solutions, Alperia has developed a proprietary product named Sybil HVAC, designed to optimize Heating, Ventilation, and Air Conditioning (HVAC) systems. Sybil HVAC embodies a sophisticated tool that integrates seamlessly with building management systems to enhance the operational efficiency of HVAC equipment, thereby reducing energy consumption and lowering carbon footprints.

The incorporation of the Haystack tagging system into Sybil HVAC stands as a testament to Alperia's commitment to technological excellence. Haystack provides a standardized semantic data model that facilitates the organization, interpretation, and utilization of IoT data within buildings. The advantages of integrating Haystack with Sybil HVAC include:

- 1. Enhanced Data Management: Haystack's uniform metadata tagging allows Sybil HVAC to process and interpret various data points effectively, fostering an ecosystem where information from diverse HVAC components is effortlessly consolidated and managed.
- 2. Intelligent Analytics: Sybil HVAC, powered by Haystack's structured tagging, enables complex data analytics, providing actionable insights into

energy consumption patterns. This empowers facility managers to make data-driven decisions for energy optimization.

- Improved Automation: Sybil HVAC leverages the Haystack framework to automate HVAC controls intelligently, adjusting to real-time environmental data, which leads to optimized energy use and improved occupant comfort.
- 4. Streamlined Maintenance: The use of Haystack tags simplifies the identification of system anomalies and performance issues, allowing for prompt and proactive maintenance actions within Sybil HVAC's operational scope.
- 5. Future-proofing: As Alperia's Sybil HVAC is equipped to handle Haystack tagging, it ensures that the system remains adaptable to future upgrades and scalable to accommodate the growth of infrastructure without compromising efficiency.

Through the integration of Haystack tagging within its Sybil HVAC product, Alperia is poised to deliver unparalleled HVAC optimization services. This strategic move not only enhances building energy management but also aligns with global sustainability goals, reinforcing Alperia's role as a leader in the transition towards a cleaner and smarter energy future.

To learn more aboaut Alperia, visit: www.alperiagroup.eu/en 💥



Midea Building Technologies (MBT) is one of the largest HVAC system manufacturer in China, providing highefficiency VRF systems, chillers, heat pumps, AHUs, and other products. A key focus of our business is providing comprehensive intelligent solutions for our customers, combining our HVAC, elevator, BAS/BMS/EMS, and cloud products to help them achieve better comfort, easier management, lower energy consumption, and reduced carbon footprint. MBT's HVAC products, such as VRF systems and chillers, are equipped with intelligent features, including automated fault detection and diagnosis, virtual backup sensors, and control optimization and etc. However, seamlessly integrating these advanced features with third-party BAS/BMS presents a challenge. By adopting Project Haystack standards and embedding tags into our products, we believe that integration can be effortless."

To learn more about Midea Building Technologies, visit: mbt.midea.com.





A t One Sightsolutions we are the leading UK supplier of reputable building automation and energy management products & services. In addition to this, we retain integration at the core of our business model, with a vision to revolutionise the connected building. From development of new technologies, to integration deployment, we are here to utilise a variety of connectivity solutions to help you achieve your goals. Why not optimise your building and bring it into the future and the Internet of Everything (IoE) with our connected building solutions!

To learn more aboaut the One SightSolutions, visit: onesight.solutions.





State of Utah "Applying Haystack Tagging for a Sample Building" Updated

One of the resources available from the Project Haystack website is a spreadsheet that documents the State of Utah job from a few years ago. This spreadsheet details the various types of equips and how they should be tagged. It also lists all the points in each equip type and documents the proper Haystack tags used. This is a great resource for anyone who is new to Haystack and trying to build their first Haystack compatible BAS database.

When Haystack 4 was released, some previously defined tags were changed or deprecated. The downloadable spreadsheet has now been updated to reflect the tag changes made in Haystack 4. If you are a Project Haystack novice and looking for help tagging a new project, you can use this file to see how to tag entities correctly.

With the 10-year anniversary of Project Haystack last year, the standard has flourished and J2 are proud to support and participate for the benefit of the industry, and ultimately for our planet. However, we believe that this is only the starting point of the Project Haystack journey; a key driver for future growth will be the increasing number of BMS, BAS and IoT products which are equipped offthe-shelf with Project Haystack based tagging to further proliferate cross product integration in buildings and related infrastructure.

On the project Haystack website, in the Marketing-> Resources->White Papers downloads is an example spreadsheet for tagging equipment and points from the State of Utah project. This is a great resource as an example of how to tag data. The problem is that this document was done prior to the advent of Haystack 4.0.

The spreadsheet has been updated to remove the old deprecated tags and replaced based on the **Changes3to4** page from Project Haystack website (https://project-haystack.org/doc/docHaystack/Changes3to4).





The Project Haystack community develops and freely offers a range of reference implementations to enable product manufacturers and application developers to quickly implement Haystack tagging and communications in their products.



Haystack Wiki: Source for docs, and tag definitions

Haystack Java Toolkit: Light weight J2ME compliant client and server implementation

nHaystack: New Updated Niagara module to add Haystack tagging and Niagara REST API for AX and N4

Haystack CPP: C++ Haystack client and server implementation

Haystack DART: Client library for Dart programming language

Node Haystack: node.js client/server implementation

pyHaystack: Python client implementation

Check out these documents and audio resources to quickly come up to speed on Project Haystack tagging benefits and the methodology.



Want to get involved in the Project Haystack open-source community? There are a number of ways and levels of involvement.



Contribute your expertise: Participate in the Project Haystack open **forum discussions**.

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-00-	

Join a Working Group: Project Haystack has members working together on developing tag sets and resolving other challenges related to particular topics. See the list of active Working Groups that you could join today <u>here</u>.



Become a Member: Project Haystack Corporate Associate Memberhip has many advantages. Email us to learn more at info@haystackconnect.org.



Here is some of the information shared by Project Haystack members on Facebook, Twitter and LinkedIn. Follow them to learn about Haystack-enabled recent projects, products and practices.



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J2 Innovations
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Project Haystack

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The Project Haystack Connections Magazine advertising program is a cost-effective way for companies that provide complementary products and services to reach the growing and dynamic Project Haystack Community. This community is at the very forefront of intelligent buildings and the IoT. Haystack Connections is a premier advertising vehicle to reach this prime audience. With 8,000+ known readers, it is an incredibly cost-effective advertising opportunity. For rate info, email:

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The Clockworks Analytics HVAC Fault Detection and Diagnostics (FDD) platform plugs into existing BMS and metering systems and analyzes thousands of data points to prioritize the building issues related to energy performance, indoor air quality and equipment operation. Our unique information model goes beyond simple fault detection by identifying the relationships between issues, diagnosing the root cause, and providing clear recommended actions. Clockworks' analytics-based monitoring allows you to proactively address building health issues, save energy and avoid reactive failures tomorrow.





Conserve It was founded in 2007 with a focus on centrifugal chiller efficiency systems. Over time it has diversified into complete HVAC&R plant management including monitoring, reporting and controls, energy performance contracting, energy management consulting and distribution of industrial and building automation products and sensors from leading international suppliers worldwide. Conserve It provides a range of unique products and services in this area.

J2 Innovations are creators of FIN Framework, a next-generation software framework for smart buildings, smart equipment and IoT applications. Natively based on Haystack tagging, FIN can integrate, control, manage, analyze, visualize, connect, and can be embedded on a controller, gateway, HMI or server. FIN Framework offers OEMs, System Integrators, and end user solutions that are faster, easier, and better.



As a leader in electrical and digital infrastructure solutions for all types of buildings, Legrand helps enhance everyday life for its customers. Legrand's Eliot program (Electricity and IoT) is speeding the deployment of Legrand's connected devices and accelerating the evolution of connected buildings. Eliot is powering development of new Legrand products for the benefit of private and professional users alike.



Embracing open software and hardware platforms, Lynxspring develops and manufactures innovative edge-to-enterprise solutions. We enable better building automation, better energy management systems, better control systems and specialty machine-to-machine and IoT applications. Deployed in billions of square feet of commercial buildings across North America and beyond, Lynxspring's smart solutions simplify integration and interoperability, and help connect your smart building's data.

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Siemens Smart Infrastructure transforms building productivity, comfort, and energy efficiency. We change how people live and work with solutions that deliver the highest level of comfort, safety, and energy efficiency in an intelligent way. Siemens delivers solutions for buildings of all sizes and complexities to make smart buildings real.



SkyFoundry's mission is to provide software solutions for the age of the "Internet of Things". Areas of focus include building automation and facility management, energy management, utility data analytics, remote device and equipment monitoring, and asset management. SkyFoundry products help customers derive value from their investments in smart systems.



75F designs and manufactures the world's leading IoT Building Management System, an out-of-the-box, vertically-integrated solution that is more affordable and easier to deploy than anything on the market today. The company leverages IoT, Cloud Computing, and Machine Learning for data-driven, proactive building intelligence and controls for HVAC optimization. 75F's mission is to improve occupant productivity through enhanced comfort and indoor air quality — all while saving energy.



Accu-Temp Systems is committed to delivering safe, comfortable environments for its customers. It leverages tools like secure mobile devices, cloud computing and advanced analytics. It offers systems integration services that help building owners protect their investment in existing direct digital controls, extending their useful lifetime while enjoying next-generation access and control.



Alperia is a sustainable green tech company providing energy services. From our beginning, nature has guided our work, making us one of the leading companies in the green energy sector in Italy today. We produce energy from renewable sources and manage the electricity grid, deal with district heating systems, we are gradually moving towards the energy transition, we take care of energy sales and e-mobility. We provide customer support at all stages of project implementation, entering the market with innovative business models.



Altura Associates is a professional services firm that goes beyond the traditional consulting model. Our team works closely with our client organizations to develop programs that offer immediate and lasting impacts, build capacity, and drive long-term value. The team combines expertise in mechanical/electrical engineering, energy management, environmental science, and financial analysis.



The Association for Smarter Homes & Buildings (formerly known as Continental Automated Buildings Association) is an international not-for-profit industry association dedicated to the advancement of integrated technologies for homes and buildings. The organization supported by an international membership of over 300 organizations involved in the design, manufacture, installation and retailing of products relating to home and building automation.

Automated Logic

Automated Logic is a global provider of high-performance, integrated building management solutions that make buildings smarter, more energy efficient, and more comfortable. Automated Logic's worldwide network of authorized partners includes over 230 field offices, with proven experience in building automation, energy management, and controls. It is also part of Carrier Global Corporation (NYSE: CARR), a leading global provider of healthy, safe, and sustainable building and cold chain solutions.



Bernhard is one of the largest privately-owned Energy-as-a-Service companies in the US with 100+ years of energy and infrastructure project experience servicing higher education, health care, commercial and specialty markets. Bernhard combines development, financing, design, construction and operations to deliver turnkey Energy-asa-Service solutions that reduce energy use, risk and cost so that our clients can focus on their everyday work.

BRAINBOX A

BrainBox AI is at the forefront of the green building revolution with its unique technology combining artificial intelligence and cloud computing to create a fully autonomous commercial HVAC solution. BrainBox AI overlays deep learning algorithms on existing HVAC functionality to automate the modulation of each component, reducing a building's total energy spend by up to 25% while improving occupant comfort by 60%. The solution leverages AI to predict building energy consumption at a very granular level and enables our autonomous HVAC system to operate the building pre-emptively.



BUENO Systems is the Australian leader in data and information driven operational property services. BUENO delivers superior data related and technology driven services based on fault detection, optimization and business intelligence that simplify their clients operations and enhance their effectiveness across all building sectors and building information systems.



At Buildings IOT, we're changing the way the built environment understands, reacts and adapts through technology. Our software and services increase the longevity of building assets, improve the comfort of building occupants and help building owners achieve greater efficiency. We develop and deploy cloud-based building analytics software, we implement complex Integrated Building Management Systems, we design and install controls systems, we maintain building assets and we provide IT managed services. We excel at all of our efforts because we know buildings.

COSTER

Coster Group offers the best for efficient management of building systems: from controllers for heating plants to the development of "custom-made" BMS. Our approach has always been to integrate technologies and building management to ensure an efficient, and at the same time, healthy living environment without ever sacrificing the simplistic use of our systems. Our in-house R&D team enables us to respond quickly to market demands for innovation. We can proudly say that we are among the companies most actively supporting the transition to sustainable and environmentally friendly buildings in accordance with the 2030 Agenda.



e-Magic Inc. specializes in providing expertise and software for the design, development, and integration of large scale industrial IoT and Azure Digital Twins solutions globally Applications include Centralized Operations, Smart Buildings, Facilities and Cities, Smart Manufacturing, Industrial production and AI for prediction and optimization. Our solutions have been installed in a wide range of industrial sectors including: buildings, facilities, manufacturing, utilities, mining and metals, cement, oil and gas, food and beverage, chemical, petrochemical and pulp and paper.



EMA is a trade association dedicated to providing education, training, and certification in the field of building and facility energy efficiency. Its Energy Management Professional certification (EMP) has achieved accreditation by ANSI and is recognized by the Department of Energy's Better Buildings Workforce® program.



Entrocim develops custom software that helps technologies communicate together. From state of the art data centers to environmentally conscious facilities, our software development team is capable of building solutions that connect anything and everything. IoT Warez offers a suite of hosted software options that provide customized solutions. Our platform-as-a-service connects multiple brands of software into one platform that can be remotely managed from a smart device.



Intellastar Technology is at the Intersection of Smart Buildings and Smart Grid. The InferStack Software Platform is deployed in Servers and T-Star Field Devices, communicates over Intellastar Connect Cellular Data Service, to provide a complete technology to deliver Smart Buildings and Smart Grid solutions.InferStack connects to the in-building systems to provide Energy Monitoring and Analysis, Analytics for Fault Detection and Diagnostic, Control for Plant Optimization--all features to make a smart building and reduce energy consumption and waste.



BUILDINGS[™]

Intellienergy Tech® is an Italian company that designs and produces remote control and monitoring solutions and systems for smart buildings and smart cities. Customer care, intuition and continuous research have led Intellienergy Tech® to become a leading Italian Company in the sector of Building Management Systems and Smart Lighting; its customers include some of the most important national and international groups dedicated to energy efficiency. Buildings in major Italian Cities are managed by Intellienergy Tech® systems, with over 25 thousand systems installed and over a million of control points.

Intelligent Buildings, a nationally recognized smart real estate advisory services company, provides planning and implementation of next generation strategy for new buildings, existing portfolios and smart communities. Their work includes "The Smartest Building in America", the largest energy analytics project in North America, the smart buildings standards for the U.S. and Canadian governments, conception and management of a Clinton Global Initiative and the recently released Intelligent Buildings CyberSafe service.



KMC Control is an American manufacturer of open, secure, and scalable building automation solutions. From secure hardware devices to smart and connected software, KMC delivers embedded intelligence and optimized control.. It is committed to providing industry-leading Internet of Things-enabled automation solutions with leading tech suppliers to increase comfort, convenience and to help reduce energy usage.



KNX Association represents KNX technology now used in applications for lighting and blind control, security systems, HVAC, monitoring, alarming, water control, energy management, smart metering as well as household appliances, audio/video and more. KNX provides a single, manufacturer-independent design and commissioning tool (ETS), with a complete set of supported communication media and configuration modes. It is approved as a European and an International standard.



Midea Building Technologies (MBT) is one of the largest HVAC system manufacturer in China, providing high-efficiency VRF systems, chillers, heat pumps, AHUs, and other products. A key focus of our business is providing comprehensive intelligent solutions for our customers, combining our HVAC, elevator, BAS/BMS/EMS, and cloud products to help them achieve better comfort, easier management, lower energy consumption, and reduced carbon footprint.



To Come.



As a Master Systems Integrator, One Sightsolutions play a crucial role in many modern Smart Building projects. It is the responsibility of the MSI to understand all of the multiple, separate building systems, and work to integrate each of those systems into a singular Smart Building solution. We are the first and largest Tridium partner in the UK, with a multi-vendor range of Niagara 4 products all under one roof.



Technology and big data are transforming the way the world lives, works and plays. But building management hasn't changed; it's still riddled with archaic spreadsheets, inaccessible data, clunky architecture and silos. It's time to improve the way we manage buildings. Switch Automation is leading that charge. Our smart building Platform combines deep insight and robust tools that help you monitor, benchmark and optimize building performance.



Tridium is a world leader in business application frameworks - advancing truly open environments that harness the power of the Internet of Things. Our innovations have fundamentally changed the way people connect and control devices and systems. Our products allow people and machines to communicate and collaborate like never before. They empower manufacturers to develop intelligent equipment systems and smart devices for enterprise and edge assets.



Through the implementation of WideSky®, we aim to unlock the value of your energy, environmental and building data. Our scalable, intelligent solutions can improve profits and sustainability of your business. The qualified and experienced WideSky team has decades of operational and information technology experience. Coupled with our partner network, we can implement future-proofed, well-supported solutions tailored to your business on a global scale.

Yorkland Controls ENVIRONMENTAL S 0 L U T I 0 N S

Yorkland Controls has roots in distributing and warehousing heating control products such as Flame Safeguard and Burner and Boiler Management Systems, and has expanded into new markets including Building Automation, Lighting, Security and Energy Services. It works to promote the advantages of controls to the industries and markets that it serves and to demystify available technology for its customers.

For all the latest Project Haystack marketing activities visit marketing.project-haystack.org.





www.project-haystack.org

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